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Environmental Argumentation as Sociocultural Activity

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Abstract: While environmental argumentation has recently received much attention from science educators, little consideration has been given to how personal identities and social relationships can either support or constrain student argumentation. This study attends to this issue by examining environmental argumentation as a sociocultural activity (how students implicitly create identities and relationships through environmental warrants and claims). By integrating rhetorical and sociocultural analysis of oral discourse, we examine argumentation about environmental dilemmas (problematic scenarios involving animals and the environment). Although students set forth a variety of warrants (social, economic, contextual, biocentric, and expertise-based), the dilemmas led to distinct forms of argumentation. One dilemma involving a pet iguana fostered non-adversarial argumentation wherein students identified themselves as animal lovers and cooperative discussants. By contrast, the other two dilemmas (the hypothetical encounter with a fawn in the woods and the observation of classroom lights being unnecessarily left on) led to the unexpected emergence of sexual identities, combative disagreement, and conflict resolution on social rather than rational grounds. The main implication of this study is that it highlights the need for educators to pay closer attention to specific textual elements in the design of environmental dilemmas (types of prompts used, decision-makers' identities, statements of intentionality and outcome, moral complexity, values of nature, and social representation or cultural images of animals) in order to foster an appropriate and productive sociocultural classroom context for rational and reasoned environmental argumentation to take place without the constraints of unexpected social complications. J Res Sci Teach
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Classroom discourse about the environment has recently received a considerable amount of attention from educators interested in the use of socioscientific issues (SSI's) as instructional contexts for learning science (Hogan, 2002; Kortland, 1996; Pedretti, 1999; Sadler, Barab & Scott, 2007; Zeidler & Schafer, 1984). While some studies have focused on the structure, justification, and content of *arguments* or student-generated products (Sampson & Clark, 2008), others have examined the process of *argumentation* (Jiménez-Aleixandre & Erduran, 2008) or *argumentation discourse* (Duschl & Osborne, 2002; Erduran, Simon, & Osborne, 2004), that is, the dialogic or interactional processes utilized by teachers and students to orally propose and justify arguments through whole-class or small-group discussions about the environment.

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Despite their growing number, few studies have previously examined sociocultural aspects of students' environmental argumentation. A few noticeable exceptions include studies of social representations (Simonneaux & Simonneaux, 2009), personal narratives and experiences (Albe, 2009; Levinson, 2008), cultural background (Evagorou, Jiménez-Aleixandre, & Osborne, in press), and personal values (Jorde & Mork, 2007) in student socioscientific reasoning. Nonetheless, most studies have treated student argumentation primarily as socioculturally neutral communicative events for the most part devoid of social identities and relationships. As a result, little attention has been paid to the personal identities and social relationships that emerge in classroom deliberations and to how such sociocultural processes can either support or constrain student scientific debate. The present study adds to this limited area of research by treating environmental argumentation discourse as sociocultural activity, that is, as a type of communicative event wherein students *create personal identities* and *negotiate social relationships* through their environmental warrants and claims.

As used in this study, the term *environmental argumentation* refers to the discursive process of oral negotiation of environmental dilemmas among elementary-school children. Central to this discursive process is student engagement in socioscientific reasoning (Sadler et al., 2007) wherein positions or claims are informally justified based on local knowledge and personal experience. Rather than resorting to formal scientific data or information, young learners rely primarily upon informal or anecdotal evidence such as personal narratives. Like Levinson (2008), we believe that ''personal narratives of students are indispensable to the teaching of controversial SSI... are complementary to the logic-scientific mode of thought and are to be used for warrants, rebuttals, and qualifiers to scientific claims in the teaching of SSI (p. 866).'' The scholarly work that informs our research efforts is reviewed next.

Argumentation, Identity, and Cooperation

Drawing upon previous scholarly work on argumentation, identity, and language use, we now review the extensive body of research that informed this study.

Environmental Argument and Argumentation

Previous research has focused mainly on assessing the quality (i.e., soundness and logical coherence) of students' environmental arguments by examining the extent to which they align with generic models such as Toulmin's (1958). This research has revealed that students often provide claims unsupported by data, poorly articulated claims, and no rebuttals (Zeidler, Osborne, Erduran, Simon, & Monk, 2003); and, tend to overlook disconfirming evidence and rely upon uncritical statement of value preferences (Hogan, 2002). Students also make varied types of arguments: qualitative (socio, ecological, economic, or practical), semi-quantitative (focused on isolated factors or relationships), and quantitative (based on intuitive or school knowledge) (Patronis, Potari, & Spiliotopoulou, 1999); and, resort to a wide range of warrants to justify their claims, including ecological concepts (e.g., biodiversity, food chains), landscape impact (e.g., aesthetics), and value hierarchies (ecological considerations over economic ones) (Jiménez-Aleixandre & Pereiro-Munoz, 2002).

Varied patterns of student environmental argumentation have been revealed, including *normative reasoning* (a tendency to make environmental arguments based on social norms) and *casuistical reasoning* (confusion between hypothetical and actual situations, and focus on the veracity of dilemmas rather than deciding on a particular course of action) (Zeidler & Schafer, 1984); *homocentric* or *anthropocentric reasoning* (i.e., nature protection arguments centered on human needs, interests, and welfare) and *biocentric reasoning* (pro-environment arguments based on appeals to the rights and intrinsic values of nature) (Kahn, 1999; Pedretti,

1999); and, *fallacious reasoning* (e.g., inability to distinguish between evidence- and opinion-based arguments, fusion of personal beliefs with scientific facts, ecological misconceptions, and simplistic and low-quality argumentation) (Barab, Sadler, Heiselt, Hickey, & Zuiker, 2006; Kortland, 1996; Sadler et al., 2007; Zeidler, Walker, Ackett, & Simmons,2002).

This body of research has for the most part overlooked the social work of student arguments in forging personal identities and social relations in the context of environmental argumentation discourse, an issue addressed by the present study.

Language and Personal Identity

A large body of research in the fields of linguistic and anthropology has previously linked personal identity to language use (i.e., ways of speaking). Central to this work is the notion that the *self* is socially or interactionally constituted. Speakers' socio-interactional patterns (i.e., the habitual ways that they orient themselves in relation to interlocutors in their social worlds) play an important role in the processes of construction of integrated personal identities. Furthermore, habitual enactment of particular interactional positions enables participants to maintain as well as transform their personal identities (Wortham, 2001). This linguistic and interactional process of *social identification* (Wortham, 2004), term commonly used in reference to the dynamic construction and transaction of identity in face-to-face interaction) is related to the *illocutionary force* (Austin, 1962; Levinson, 1983; Searl, 1972) of speakers' utterances (i.e., what they accomplish *through* what they say and how they talk). Such illocutionary force is often achieved implicitly through *indexicality* (Silverstein, 1992, 1995), that is, non-verbal means such as pitch, tone of voice, speed, gesture, and facial expressions (Labov, 1972; Tannen, 1985). By implying certain evaluative attitudes toward the message and hearers, speakers indexically communicate their perceptions of relative social status of those addressed and referred to.

In addition to implying who they are (i.e., their personal identities, rights, responsibilities, and social statuses), speakers also adopt certain *footings* (Goffman, 1981), that is, take up particular positions or interactional alignments in relation to one another. A good example is small talk at the beginning and end of a lesson or activity (participants temporarily shift into a casual and playful footing). Further, speakers can change their footing on a moment-to-moment basis, shifting their footing rapidly and in unexpected ways.

Similarly, in the present study, we adopt a dialogic, socioconstructivist perspective on the self, viewing personal identities as being partially constituted via interactional positioning in the course of environmental argumentation. Like Blot (2003) who argues that ''language is inescapably a badge of identity... whenever we open our mouths to speak we provide those who hear us, chosen interlocutors and mere bystanders alike, with a wealth of data, a congeries of linguistic clues others use to position us within a specific social stratum,'' we consider students' environmental warrants and claims to play an important role in the processes of construction of an integrated personal identity (i.e., the formation of a coherent sense of self).

Student Identity in Science Instruction

Similarly, science educators have examined students' negotiation of personal identities through engagement in linguistic activity (i.e., science classroom discourse). It has been reported that students who are able to accurately use scientific language are presumed to be more knowledgeable and hold a higher status than those who use everyday terms (Brown & Ryoo, 2008). Students surrounded by others who are alike have been shown to develop *affinity identity* (Gee, 2000) through group interactions (Brown, Reveles, & Kelly, 2005). And, successful learning of science was previously connected to student transition through a series of

discursive identities over the academic year (Brown, 2004) and to the development of a personal identity as a ''knower of science'' through interactions with teacher and peers (Brickhouse & Potter, 2001).

In contrast, students who struggle with identity issues avoid using science discourse (Brown, 2004), make low-quality contributions to class argumentation (Cross, Taasoobshirazi, Hendricks, & Hickey, 2008), make identity-affirming gender-biased evaluations of science (Morton, Haslam, Postmes, & Ryan, 2006), and feel tension between personal and professional affiliations (Nasir & Saxe, 2003; Tate & Linn, 2005; Yoder, 2000). Students who are in lower tracks often adopt an *oppositional identity* (Gilbert & Yerrick, 2001), and students who perceive their own personal identity as too different from others' can become disengaged, and have problems in developing scientific literacy (Brickhouse & Potter, 2001; Brown et al., 2005; Calabrese-Barton, 1998; Reveles, Cordova, & Kelly, 2004).

A number of studies have previously considered students' social roles and identities in classroom discussions (Lemke, 1990; Varelas et al., 2007; Engle & Conant, 2002; Rosebery, Warren, & Conant, 1992). However, this research has focused mostly on discussions other than environmental. Others examined student identity in the context of community-based action outside schools wherein students have direct physical contact with the environment and nature (Bouillon & Gomez, 2001; Calabrese-Barton, Tan, & Rivet, 2008; Calabrese-Barton & Tan 2010a; b), but this research has paid little attention specifically to student argumentation.

Also previously examined is homosexual identification in biology textbooks (Bazzul & Sykes, 2011; Reiss, 1998; Snyder & Broadway, 2004; Temple, 2005). This research points to an international trend of censorship (an utter lack of visual representations of alternative sexual identities), misrepresentation and miscommunication of same-sex identities and to the promotion of *heteronormativity*—the hegemonic and privileged construction of heterosexuality as a standard for what counts as normal and acceptable with regard to gender and sexuality (Britzman, 1997; Warner, 1991). As a result of being positioned as ''abnormal,'' students with alternative sexualities can have difficulty constructing a coherent and integrated sense of self (Abes & Kasch, 2007; Kumashiro, 1999; Renn, 2007; Wilson, 1996).

The above literature underscores the multiplicity of students' personal identities as well as the importance of science classroom experiences for their formation. Similarly, in the present study, we examine students' constitution and negotiation of multiple personal identities (with regard to cooperation, the environment, animals, and sexual orientation) through engagement in linguistic activity (i.e., environmental argumentation) with peers.

Cooperative Communication

Communication scholars have emphasized that speaker participation in conversation is guided by the general *cooperative principle*, which Grice (1989) defines as ''make your conversational contribution such as is required, at the stage at it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged'' (p. 26). Subsumed under this general principle are a series of maxims (specific guidelines) in which Grice (1989) outlines rational and efficient ways whereby speakers can successfully conduct cooperative communication (i.e., establish efficient cooperative relationships with others):

> [Maxims of Quantity:] 1. make your contribution as informative as is required for the current purposes of the exchange) [and] 2. Do not make your contribution more informative than is required... [Maxims of Quality:] Try to make your contribution one that is true... 1. Do not say what you believe to be false [and] 2. Do not say that for which

> you lack adequate evidence... [Maxim of Relation:] Be relevant... [Maxims of Manner:] Be perspicuous... 1. Avoid obscurity of expression, 2. Avoid ambiguity, 3. Be brief (avoid unnecessary prolixity), [and] 4. Be orderly (pp. 26–27).

Grice's cooperative principle and conversational maxims provide a small set of rational guidelines and reasonable assumptions (i.e., the informal logic underlying conversational relationships) that can be used to generate *implicatures*, that is, infer what speakers implicitly mean or ''implicate'' when they follow or fail to observe the conversational maxims. Levinson (1983) defines implicatures as ''inferences based on both the content of what has been said and some specific assumptions about the co-operative nature of ordinary verbal interaction'' (p. 104). A special kind of implicature arises when the participant in talk exchanges deliberately, violates or breaches a conversational maxim for communicative purposes (i.e., to purposively implicate something). Such usage is referred to by Grice (1989) as floutings or exploitations of conversational maxims, and has been previously observed in educational settings.

In the academic context of classroom discussions, students are subject to a higher degree of accountability for complying with Grice's cooperative principles and maxims of quantity, quality, relation, and manner (Forman & Larreamendy-Joerns, 1998; Hilton, 1990). To felicitously or successfully make an oral contribution to a discussion, a student must speak clearly, sincerely, and relevantly while supplying sufficient, complete, veridical, and logically coherent information. This requirement is reinforced by the teacher who regulates students' discursive participation (Forman & Larreamendy-Joerns, 1998). Nonetheless, children have been shown to consciously and ostentatiously flout Gricean maxims as a means to express playfulness and humor (Forman, 1992).

In the present study, we examine the implicatures of claims and warrants made orally by students during environmental discussions. By doing so, we systematically examine how students negotiate cooperative social relationships with peers through mutual regulation and accountability for following the Gricean maxims during environmental argumentation.

The Intrinsic Link

Though drawn from multiple and distinct fields of scholarship, when looked together, the above body of research enables us to recognize that environmental argumentation, student identity, and language use are intrinsically linked. Because environmental argumentation constitutes a form of cooperative communication or language use, student claims and warrants inevitably serve as conduits for the creation of personal identities and negotiation of social relationships. As such, this rhetorical language provides students with a linguistic means to purposively interact and manipulate identity and relation.

Research Questions

Based on the above literature review, we propose the following research questions:

1. What *types of claims and warrants* do students make during environmental argumentation?
2. What *personal identities* do students construct through warrants and claims made during environmental argumentation?
3. How do students negotiate *cooperative social relationships* through warrants and claims as revealed by their regulation and accountability for following the Gricean maxims during environmental argumentation?

Methodology

In this section, we describe our methods of data collection and analysis.

Data Collection

Data for this study comes from video-recorded classroom observations of a fourth-grade Brazilian classroom during a 50-minute lesson on environmental stewardship. The lesson was based on three activities entitled *Ethi-Reasoning* and *Ethi-Thinking* (CEE, 2003), and *Eco-Ethics* (Population Connection, 2004). Originally developed by environmental educators in the US as part of the Project Wild and Population Connection curricula, these activities are composed of dilemma cards—short narratives wherein students are provided with problematic scenarios involving wildlife and the environment, share their views and opinions, and decide upon appropriate solutions through reasoning and argumentation. The objectives of utilizing these dilemma cards are to encourage students to articulate ideas, beliefs, and actions concerning wildlife and the environment as well as question and evaluate the decisions of peers. Despite their original ties to an American instructional context, wildlife and environmental protection remains a worldwide problem, making the environmental dilemmas also relevant to teachers and students in different cultural and linguistic contexts.

In this study, we examine whole-class discussions (in Portuguese) that followed the teacher reading aloud three dilemma cards translated literally into Portuguese: Classroom Lights, Pet Iguana, and Fawn in the Woods (see Table 1). Discussion of each of these dilemma cards lasted between 10 and 15 minutes. One researcher (Author 1) worked collaboratively with the fourth-grade teacher, translating the activity into the Portuguese language prior to its classroom implementation. Because Author 1 was a fluent speaker of both English and

Table 1
Environmental dilemmas

Dilemma	Scenario
Classroom Lights	As your class is going to lunch, you notice that the lights are still on. What do you do and why? Would you: Turn off lights yourself? Point it out to the teacher or principal? Start a class discussion about saving energy? Do nothing? Other? (specify)
Pet Iguana	After months of pleading, you were given a pet iguana for your birthday. Along with the pet came a book discussing how to best take care of your pet. Until then, you and your parents were not aware that reptiles can live 25 or more years in captivity. Several months have passed and you are tired of feeding, watering and cleaning up after your new pet. What would you do and why? Would you: Flush the iguana down the toilet? Let the pet go outside knowing that it is an exotic species for your area? Beg a friend to take your iguana without telling them about the long life of the pet? Secretly drop the pet off on the door step of a local veterinarian? Other? (specify)
Fawn in the Woods	You are walking in the woods and come upon a young fawn. There is no sign of the fawn's mother. Would you: Leave the fawn where it is? Move the fawn to a sheltered area? Take the fawn home? Do something else?

Portuguese, he was able to help the elementary teacher translate the dilemma. In spite of this assistance, the teacher remained in control of the translation process, making all decisions with regard to how to translate the narrative. The teacher had the freedom and authority to make any changes or adaptations to the translated dilemma cards before classroom implementation. Overall, translation into Portuguese was literal, that is, without any significant alterations to the referential contents of the original dilemma cards. For a more information about the curriculum translation process and its implementation, see Oliveira, Colak, and Akerson (2009a, 2009b) and Oliveira and Dhingra (2008).

The main method of data collection was participant observation (Dewalt & Dewalt, 2002). Author 1 participated actively in the preparation and implementation of the environmental dilemma cards by purchasing needed material (paper, pencils, erasers, etc.), and providing logistic and instructional assistance to the teacher and students when needed (e.g., making copies of the dilemma cards, and co-facilitating whole-class discussions with the teacher). Furthermore, Author 1 recorded the classroom implementation of the dilemma cards with a video camera, took notes of classroom interactions and interacted with the students. Each dilemma card was read aloud by the teacher and then followed by a whole-class discussion facilitated mainly by Author 1; the teacher intervened as needed, especially to address student behavior issues. These video-recordings constituted the main corpus of data for our analyses.

Participants in this study included 30 fourth-grade students at a public school in Brazil. Their ages were mostly in the range between 9 and 12 years old. Consisting of 13 females and 17 males, the class was presided over by Ana, a teacher in her mid-50s with approximately 10 years of teaching experience. The school where Ana worked offered grade levels 1 through 8 to a student population of approximately 200. Most of these students were of mixed descent (European, African, and Native) and came from lower-income rural families.

Data collection occurred in early August—the beginning of the second school semester in Brazilian elementary schools where the school year usually runs from February to December, with a summer break in January and a winter break in July. At the time of data collection, students and Ana had already been together for several months. Although many students knew each other from previous years, this was the first time they had Ana as a teacher. Furthermore, previous instruction had been mostly limited to lectures and rote learning, and students had not received any form of instructional support around classroom argumentation and discussion.

Data Analysis

Whole-class discussions were transcribed and analyzed using theoretical concepts drawn from the fields of rhetoric and sociolinguistics. This analysis focused on two distinct dimensions of environmental discussions, namely rhetoric and sociocultural activity. As part of our analysis of the rhetoric dimension, Toulmin's (1958) theoretical model was used to identify argument components—data, claim, and warrants—in students' utterances (Supporting Information Figure 1). In the specific instructional context examined in this study (i.e., whole-class discussions aimed at solving environmental problems introduced by teacher aloud reading of dilemma cards), *Data* is defined as the personal narratives (informal or anecdotal evidence) presented by a student orally as grounds for their environmental arguments. During discussion of the environmental dilemmas, students typically used their personal experiences and local knowledge (e.g., "*there is no thingie* [switch] *to turn it [our classroom light] off*"), but sometimes they also relied on hypothetical information from the dilemma cards (e.g., the classroom lights are on, an Iguana is a pet, there is a fawn in the woods). By contrast, a *Claim* is the course of action proposed by a student to resolve the environmental problem in a dilemma card (e.g., "*I would move him* [fawn] *to a safe area*"). Claims require justification

and can be questioned, challenged, or even rejected by other discussants. Moreover, in the present study, students had the option of simply selecting from the set of listed Claims that followed each environmental dilemma (e.g., "*flush the iguana down the toilet*," Table 1 above) or make a new and original unlisted Claim (e.g., "*I would drop him* [Iguana] *at a zoo*"). And, thirdly, a *Warrant* is viewed as an utterance used by a student to justify making a particular rhetorical move from Data to Claim, that is, to explicate the reasoning behind a selected course of action in seeking to solve a given environmental dilemma. Furthermore, building upon previous work on classroom argumentation by Kelly, Druker and Chen (1998) as well as Jiménez-Aleixandre & Pereiro-Munoz (2002), student Warrants were grouped into several categories— social, economic, environmental, contextual, biocentric, and expertise—depending upon their referential contents, that is, the nature of the specific verbal references (e.g., animal welfare, financial costs, amount of knowledge) made by students while seeking to support and justify their claims (e.g., "*because the vet would take better care of it* [iguana] *than me*"). For definitions and examples of each student Warrant type, see Tables 2–4 below.

Our decision to adopt Toulmin (1958)'s argument layout over other theoretical models (e.g., Mitchell & Riddle, 2000; Walton, 1996) was motivated by our analytical goal of examining the structure, nature, and quality (i.e., soundness and logical coherence) of students' environmental arguments. As emphasized by Andrews (2005), "*the particular function of this model* [Toulmin's] *is to provide a test for the soundness of arguments*" (p. 114). Nonetheless, it should be noted that in this paper, we adopt a simplification of Toulmin's model (see Supporting Information Figure 1) that excludes the argument component of *Backing* (a theoretical assumption or generalized background knowledge that establishes the student warrant). The main reason for excluding Backing is that this component frequently remains implicit and unstated in oral argumentation, making it difficult to distinguish between Backings and Warrants (Jiménez-Aleixandre & Pereiro-Munoz, 2002). Other two argument components also excluded from our analysis were *Qualifier* and *Rebuttal* (mostly absent from the observed environmental discussions).

We also analyzed a second dimension of environmental discussion: sociocultural activity. To do so, we conducted a *microethnography*, a term commonly used by sociolinguists in reference to the study of video-recorded social interaction in minute detail through an up-close and exhaustive examination of how people use language and other forms of communication to realize the social work of their daily lives (Erickson, 1996), or as Gee and Green (1998) define it "a research language that describes the ways members of a social group construct the structures of daily life" (p. 132). Like other forms of discourse analysis guided by an ethnographic perspective, its goal is to describe, explain, and understand local systems

Table 2
Student warrants during the classroom lights dilemma

Warrant type	Student warrants (highlighted)
Social	I turn them off myself **to avoid fighting with others**.
	I turn them off myself **because no one else does**.
Economic	I turn them off myself **to save the school electricity**.
	I turn them off myself **because otherwise it will use up the school electricity and it will get disconnected**.
	To save electricity.
Environmental	**To help the environment**.
	We don't turn it off [ourselves] **because the light can't be turned off in here.**
Contextual	**There is no thingie** [switch] **to turn it** [light] **off.**

Table 3
Student warrants during the Iguana pet dilemma

Warrant type	Student warrants (highlighted)
Biocentric	I would drop it [iguana] off at the vet's door**, for the vet to heal and take care of him**.
	I would take him and drop him at the door of the vet **to take care of him**.
	I would give it to the vet, **for him to take care of it and so it would be much happier and well taken care of**.
	Or I would drop him at a zoo, **then the zoo would give him food, give him everything, and if they beat him up, I would beat them up too**.
	I'd give it to a friend of mine to take of it, **so it wouldn't die**.
	I would give it to the zoo **to take care of him, give him food**.
	If I didn't take it to the veterinarian, **he would get sick**.
	I would give it to the zoo, **for the zoo to take care of him properly**.
Expertise	I'd drop it at the vet's door **because the vet would take better care of him than me**.
	I'd give it to the vet **because he knows how to take care of it and he has more patience**.
	He [vet] **knows much more than we do**.
	I would prefer to take it to the vet than to keep him with me **because I don't know how to take care of it, the vet knows much better**.

of meaning making (i.e., how people interact through language use in an immediate local context) in depth. Unlike macroethnography, which typically takes the form of longitudinal studies conducted for longer periods of time, microethnography is concerned with the moment-by-moment, real-time unfolding of speech. Its focus is particularistic (providing insight into localized patterns of communicative behavior in particular social contexts). This microethnographic analysis focused on students' personal identities and cooperative social relations.

Our sociocultural analyses were conducted at two different analytical levels or units. The first unit of analysis used was *student utterances*, which are defined as individual and isolated communicative acts such as sentences or phrases performed orally by students while participating in whole-class discussions. Our second unit of analysis was *key cultural scenes* or *episodes*, which are defined as short naturally occurring conversational stretches of variable number of utterances (Erickson, 1996). Here, we focus on episodes wherein two alternative courses of action emerge during student deliberation of environmental dilemmas, leading in some instances to adversarial student argumentation (characterized by explicit challenge and

Table 4
Student warrants during the fawn in the woods dilemma

Warrant type	Student warrants (highlighted)
Biocentric	I would move him to a safe area **because he is just a baby and does not have a mother to take care of him**.
	We would take the fawn to a safe area **because where he is there are hunters that can kill him, and there was no food for him to eat**.
	If I saw that there was no safe place there, I would take him to a place where **there was a family of deer**.
	If I left him where he is **the predators could eat him**.
	You have to take him to a safe place **where there are fawns who he can survive with, like his brothers or buddies**.
	Also, a hunter could have killed his mother, then I would take him to a safe place where there are other animals like him **to help him survive**.
	I would take him to a safe place **otherwise others could capture him and kill him to eat**.
	If I left him there, **hunters could kill him**.

disagreement) and in others instances to non-oppositional patterns of whole-class student interaction (characterized by the harmonious co-existence of alternative courses of action).

As part of our analysis, we also constructed *sociocultural-argumentative maps* that depicted both rhetorical and sociocultural patterns in key cultural scenes visually (Figures 1–3). To do so, discussion around each dilemma card was first transcribed in its entirety and then systematically incorporated into a sociocultural-argumentative map that combined features of previously used visual representations of classroom oral argumentation (Chinn & Anderson, 1998; Maloney & Simon, 2006; White, 2004) as well as diagrammatic representations of social interaction (Oliveira, 2011; Wortham, 2001). Such analytical approach allowed us to visually examine the soundness of student arguments (represented by solid lines) without overlooking the underlying sociocultural activity, that is, the types of personal identities and social relations implicated by students (symbolized by grey id badges and dotted lines, respectively) while orally articulating their environmental arguments. Our decision to combine different forms of representation of classroom discourse was motivated by our desire to overcome the weaknesses and limitations of individual theoretical models, namely their failure to analytically attend simultaneously to both the rhetorical and sociocultural aspects of environmental discussions. As emphasized by Andrews (2005), ''although a number of different theoretical models (both visual and verbal) of argumentation for education are currently available, each model inevitably simplifies arguments by making certain key theoretical elements salient as means to ''look beneath the surface of argument as manifested in verbal form to the deeper structures that underpin the movement of ideas (p. 124).'' In the present

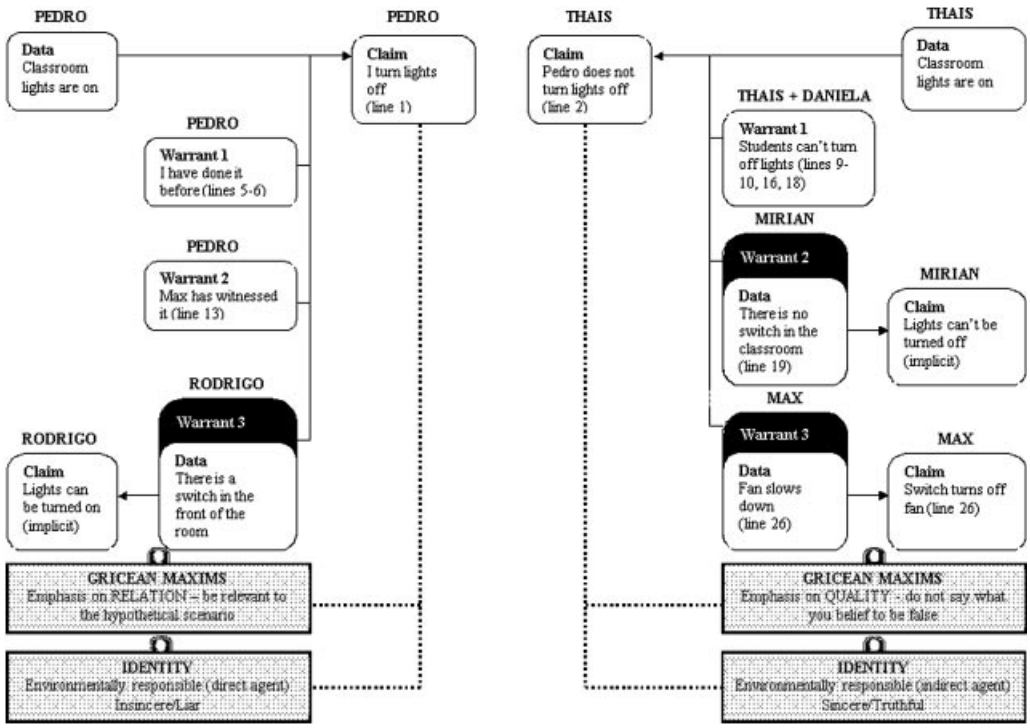

Figure 1. Sociocultural argumentative map of whole-class discussion about the classroom lights dilemma.

study, we seek to overcome this theoretical limitation by combining argumentative and relational diagrammatic depictions as well as verbal and visual discursive models into a single analytical framework.

Multiple strategies were adopted during data collection and analysis to enhance construct validity and reliability. First, our approach to data collection was aligned with a tradition of anthropological research known as ''native ethnography'' (Russell, 2002). Author 1 became a participant observer in the cultural context where he grew up and was educated. This ensured familiarity and skillfulness with each cultural context and the language of instruction. Second, *peer debriefing sessions* were frequently held during data analysis wherein key scenes were examined collectively, individual analyses shared, and interpretations discussed extensively. The emergent account was gradually adjusted to include any variation that surfaced from this reflective group interpretation. These sessions were frequently held to triangulate emerging interpretations of the data and guard against individual researcher biases (Robson, 2002).

Peer debriefing sessions were particularly important for Author 1. As a self-identified, openly gay male (a fact unknown to the students) in a personal relationship with the teacher (Ana was his mother), Author 1 unexpectedly found himself in the difficult position of having to confront students' homophobic discourse publically (while facilitating the discussion about the fawn dilemma) and in the presence of his mother, who he had recently come out to and maintained a strained personal relationship with ever since. Because, this particular discussion acquired such a high level of personal significance for Author 1, it received a considerable amount of personal introspective reflection during our peer debriefing sessions. However, a systematic effort was made not to allow this personal significance to become a source of researcher bias or to detract us from our main focus, namely student environmental discourse.

Findings

In this section, we describe and illustrate student argumentation around each environmental dilemma, focusing sequentially on the classroom lights, pet iguana, and the fawn in the woods dilemma. Transcribed excerpts of the original oral discourse in Portuguese (left-hand column) are presented alongside literal translations into English (right-hand column).

The Classroom Lights Dilemma

After the dilemma card was read aloud by Ana, Author 1 opened up the discussion floor by asking students to select an appropriate course of action (i.e., make a claim) to solve the issue of noticing the classroom lights on upon leaving for lunch (data), and to justify their selected solution (i.e., to provide a warrant). Although all students agreed that the classroom lights should be turned off before leaving the classroom, students initially disagreed as to whether the best course of action would be turn off the lights themselves or to point it out to the teacher or principal. Students were divided nearly in half between these two alternative positions and, as can be seen on Table 2, justified their claims with various types of warrants. Most students set forth either *social warrants* (focused on social relationships with others) or *economic warrants* (centered on the economic or financial consequences of leaving the classroom lights on), with only one student expressing her personal concern with environmental preservation (i.e., offering an *environmental warrant*). The fourth and last type of warrant was *contextual* (focused on the immediate and observable classroom context).

Later in the discussion, a female student named Thais directly challenged Pedro's claim that he would turn the classroom lights off himself on contextual grounds:

EXCERPT 1

1	Pedro: Se eu ver ligado, eu volto aqui e desligo	Pedro: If I see it on, I come back here and turn it off.
2	Thaís: Não desliga.	Thais: No you don't.
3	Autor 1: Vocês vêm aqui e desliga?	Author 1: You come here and turn it off?
4	Meninos: Vêm.	Boys: We do.
5	Pedro: Teve um dia, agente tava lá jogando e eu	Pedro: One day, we were out there playing and I
6	vim cá pra desligar.	came here to turn it off.
7	Thaís: Não vem nada, não vem nada.	Thais: No you don't, no you don't.
7	Autor 1: Um de cada vez, fala Thaís.	Author 1: One at a time, go ahead Thais.
9	Thaís: Nós não desliga porque aqui dentro não tem	Thais: We don't turn it off because the light can't be
10	como desligar as luzes, quem desliga é a tia.	turned off in here, the lunch lady turns if off.
11	Autor 1: Vocês tem que falar a verdade, né?	Author 1: You've gotta speak the truth, right?
12	Pedro: Toda vez que nós vai pro recreio nós desliga.	Pedro: Every time we go out for recess, we turn it off.
13	Pergunta pro Max pro cê vê.	You can ask Max.
14	Meninas: Mentira, mentira.	Girls: It's a lie, it's a lie.
15	Autor 1: Fala, Daniela.	Author 1: Go ahead, Daniela.
16	Daniela: Mentira porque aqui na sala não desliga	Daniela: It's a lie 'cause it can't be turned off here.
17	Autor 1: Desliga não?	Author 1: There is no way to turn it off?
18	Daniela: Desliga é lá na cantina.	Daniela: It can be turned off only in the cafeteria.
19	Mírian: Aqui nun tem, aqui num tem trenzin pra	Mirian: There is no, there is no thingie to turn it off
20	desliga.	here.
21	Autor 1: Pois é, onde que vocês vão desligar? Nun	Author 1: Well, how do you turn it off? There is no
22	tem interruptor.	switch.
23	Rodrigo: A lá [aponta para um interruptor na	Rodrigo: It's there [points to a switch in front of the
24	frente da sala]	room]
25	Autor 1: Desliga lá, é?	Author 1: Does it turn off there?
26	Max: Aqui desliga é o ventilador, ó [levanta e	Max: Here you turn the ceiling fan, look [he gets up
27	desliga o ventilador]	and switches off the ceiling fan]

Pedro begins the above discussion by claiming that he takes it upon himself to ensure that the classroom lights are turned off during the lunch break (line 1). It should be noted that Pedro uses the verb "to turn off" in the simple present, indicating that he is referring to a recurrent environmentally responsible behavior that he actually engages in rather than a course of action that he would hypothetically take in an imagined situation as described in the dilemma card. Pedro's claim is immediately challenged by Thais (lines 2 and 7) who expresses disagreement with the contextual premises of his claim (Pedro's proposed solution to the environmental dilemma presupposes agreement that there is a switch in the classroom and that any student can in fact turn off the lights). Rhetorically speaking, Thais concentrates on challenging the veradicality of Pedro's claim and convincing him of its implausibility by pointing out the impossibility of solving the environmental dilemma through direct action in their immediate classroom context (lines 9–10). While seeking to support his position against Thais' challenge, Pedro resorts to two social warrants: a previous instance in which he was accompanied by other boys (lines 5–6) and his friend Max's witnessing of his claimed environmentally responsible behavior (line 13); in both instances he seeks to establish the validity of his claim by appealing to his social relationships with male peers.

From a sociocultural perspective, the two students adopt an oppositional footing in relation to one another, with Thais assuming the social role of an evaluator (typically a teacher role) and at the same time positioning Pedro as the defender of a claim (as opposed to a mere articulator). As visually depicted on the sociocultural argumentative map of Excerpt 1 (Figure 1), Thais and Pedro's oppositional footing quickly gives rise to a gender divide in

which two opposing factions of students (boys vs. girls) seek to support two contradictory claims. Daniela and other girls explicit declare their agreement with Thais (lines 14, 16, and 18), whereas Mirian points out that there is no switch in the classroom (lines 19–20), observational data that serves as a contextual warrant and presupposes agreement with Thais' claim. By contrast, Rodrigo aligns himself with Pedro's position by noting that Mirian's observational data is inaccurate as a switch can in fact be seen in front of the classroom (line 23); his observational data serves both as a direct challenge to Mirian and as a contextual warrant in support of Pedro's claim. Then, in line 26, Max settles the debate by getting up, walking to the switch identified by Rodrigo and turning it off. In doing so, he presents empirical evidence (data) that serves as a contextual warrant in favor of Thais' claim, hence managing to successfully convince the other boys that the most plausible solution to the environmental dilemma is to inform the teacher or principal that classroom lights are being unnecessarily left on during recess (i.e., leading the two opposing student factions to reach consensual agreement). Lastly, it should be noted that several students (Mirian, Rodrigo, and Max) introduce contextual warrants with *consequential referents* (Kelly et al., 1998), that is, warrants that are in fact embedded sub-arguments (represented as black boxes on Figure 1).

Several conversational implicatures can be drawn from the student arguments in Excerpt 1. First, by expressing their objection to the fact that Pedro's claim presupposes the existence of a light switch in the classroom, Thais and the other girls invoke the first maxim of quality (do not say what you believe to be false). In other words, the girls' challenging arguments implicate reinforcement of a certain degree of accountability for the veridicality or truth of one's oral contribution to the discussion of this environmental dilemma. Similarly, Max's decision to get up and test the switch in front of the classroom invokes the second maxim of quality (do not say that for which you lack adequate evidence). In seeking to provide evidence of the electric device truly affected by the switch, Max demonstrates his compliance with this particular conversational maxim. In sharp contrast, Pedro seems to have a different conception of cooperative participation in the discussion of this environmental dilemma (i.e., rely on a different form of the Gricean Cooperative principle). Pedro appears (at least initially) to interpret the exchange as a discussion about a hypothetical situation. From this perspective, whether a light switch actually exists and whether it is actually possible to turn the lights off in the classroom is irrelevant, thus invoking the maxim of relation (be relevant). In other words, Thais and Pedro's opposition suggests a reliance on distinct Gricean maxims, likely a consequence of their different interpretations of what cooperative social relationships entail during the discussion of this environmental dilemma (taken as literal situation by the former, and as a hypothetical situation by the latter).

Students' adversarial argumentation in Excerpt 1 also provides evidence of distinct patterns of social identification (Figure 1). First, because all students agree that the classroom lights turn off, they all seem to share a common social identity as environmentally responsible individuals. However, some students take on the role of direct agents of environmentally responsible action (Pedro and others who argue that they turn the lights off themselves), whereas others position themselves as indirect agents (Thais and her supporters) who, due to contextual constraints, need to rely on others to take such action. Moreover, due to their different take on the Gricean maxim of quality, the former group is interactionally constituted as insincere people (liars), while the latter as sincere and truthful individuals.

The Iguana Pet Dilemma

During Ana's aloud reading of this dilemma card, students requested a clarification about the specific animal being referred to as an "iguana," a species unknown to the students who

were familiar only with smaller types of lizards commonly known in Brazil as ''calangos'' (members of the families Teiidae and Tropiduridae with up to 30 centimeters in length). In response to the students' request, Author 1 provided the following background information orally: ''*they* [Iguanas] *are from Mexico, similar to our calangos here but, instead of being small, they are much bigger, like a big calango*.'' From a rhetorical perspective, the data (i.e., the givens or facts) provided by the narrative were unclear to students who required further clarification before being able to engage in environmental argumentation (i.e., to make warranted moves from data to claims). Subsequent to this clarification, most students provided arguments in favor of two alternative courses of action: dropping the iguana off at a veterinarian (a claim listed in the dilemma card read aloud by Ana) and taking the iguana to a zoo (an unlisted claim introduced by Jose and also supported by other students). As shown on Table 3, students' selection between these two claims was justified mainly on the basis of *biocentric warrants* (i.e., explicit statements of personal concern with the iguana's needs and welfare that suggested an underlying view of animals as intrinsically valuable and important) and *expertise-based warrants* (i.e., reliance on veterinarians' relatively larger knowledge-based expertise).

As the deliberation about this environmental dilemma unfolded, a student named Jose expressed his belief that taking the iguana to a zoo (although no zoo actually existed in the students' hometown) would constitute an appropriate alternative to dropping the lizard at a local veterinarian, the solution until then unanimously favored by other students:

EXCERPT 2

1	Thaís: Eu deixaria na porta do veterinário porque o	Thais: I'd drop it at the vet's door because the
2	veterinário ia cuidar dele melhor do que eu.	vet would take better care of him than me.
3	Autor 1: Certo	Author 1: Right.
4	Idalina: Eu daria pro veterinário porque ele sabe	Idalina: I'd give it to the vet because he knows how
5	cuidar e ele tem paciência pra cuidar mais.	to take care of it and he has more patience.
6	Felipe: Eu daria pro veterinário para cuidar dele e	Felipe: I would give it to the vet, for him to take
7	assim ele ficaria bem mais feliz bem	care of it and so it would be much happier and well
8	cuidado.	taken care of.
9	Autor 1: Umhum.	Author 1: Umhum.
10	José: Ou então deixava ele nun zoológico	Jose: Or I would drop him at a zoo.
11	Bruno: é mesmo!	Bruno: Right!
12	José: Aí o zoológico dava comida, dava tudo	Jose: Then the zoo would give him food, give him
13	quanto é coisa pra ele, e se bate nele eu	everything, and if they beat him up, I would
14	bato neles também [risos]	beat them up too [laughs].
15	Autor 1: Alguém mais?	Author 1: Anyone else?
16	Bruno: Eu acho que eu dava pro zoológico,	Bruno: I think that I would give it to the zoo, like
17	igual ele tava falando alí, eu dava pro zoológico	he was saying, I would give it to the zoo to take
18	cuidar dele, da comida pra ele.	care of him, give him food.
19	Mírian: Se eu nun levasse pro veterinário, ele	Mirian: If I didn't take it to the veterinarian,
20	ficava doente.	he would get sick.
21	Luís: Eu preferia levar ele pro veterinário do que	Luis: I would prefer to take it to the vet than to
22	ficar ele comigo porque eu nun sei cuidar uai,	keep him with me because I don't know how to
23	o veterinário sabe muito mais.	take care of it, the vet knows much better.
24	Autor 1: Umhum. Alguém mais?	Author 1: Umhum. Anyone else?
25	Felipe: Eu daria pro zoológico, pro zoológico	Felipe: I would give it to the zoo, for the zoo to
26	cuidar dele direito.	take care of him properly.

When prompted to consider what to do with an unwanted iguana, Thais, Idalina, and Felipe initially express consensual agreement by repeatedly claiming that they would drop the iguana off at a local vet, a decision justified on both expertise grounds (lines 2 and 4) as well

as biocentric grounds (line 7). However, instead of simply agreeing with the position articulated by the other students, Jose introduces an alternative idea, namely to take the iguana to a local zoo (line 10). Like the other students, Jose articulates his claim as a first-person declarative with the grammatical structure "[I] + [WOULD] + [action verb]," an indication that he is speaking hypothetically or conditionally (i.e., his proposed course of action would be taken only if certain conditions were met, namely that an iguana pet and a local zoo actually existed). Unlike Pedro who claimed an actual environmentally responsible behavior as a solution to the classroom lights dilemma, Jose argues hypothetically in favor of taking the iguana pet (a hypothetical exotic pet) to a local zoo (a hypothetical place). This alternative to taking the iguana to a vet was also warranted on biocentric grounds (i.e., meeting the iguana's needs and welfare).

Although two alternative resolutions emerged during this discussion about the iguana pet dilemma, students did not adopt an oppositional footing or engage in adversarial argumentation (Figure 2). Instead, both Jose and Thais (the main arguers behind the two alternative positions) took on the roles of mere *articulators* (as opposed to evaluator/defender) of solutions that appear both compatible and non-contradictory. Unlike the previous argumentation over the classroom light dilemma, students made no counterclaim in direct opposition to other arguers or challenged alternative positions (i.e., adopted a non-oppositional argumentative footing). Moreover, although some students like Felipe changed their position from taking the iguana to a vet (lines 6–8) to taking it to a zoo (lines 25–26) in the course of the discussion, the argument was never brought to a closure (i.e., no consensual agreement was achieved and

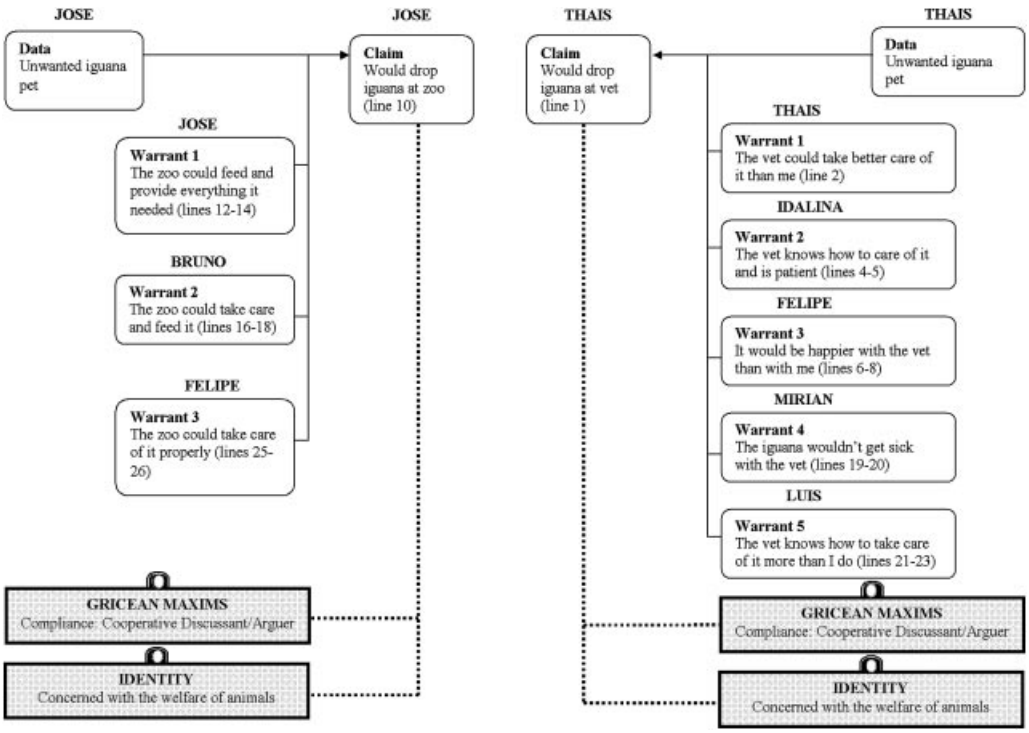

Figure 2. Sociocultural argumentative map of whole-class discussion about the iguana pet dilemma.

plural perspectives continued to coexist harmoniously). Rather, students like Bruno (lines 16–18), Mirian (lines 19–20), and Luis (lines 21–23) simply reinforced both Jose' and Thais' claims, slightly modifying and rewording the biocentric and expertise warrants previously given by others.

With regard to cooperative social relationships, the non-oppositional argumentation in Excerpt 2 provides clear evidence that students adhered to the Gricean maxims and general cooperative principle during the discussion about the iguana pet dilemma. By speaking sincerely, relevantly, clearly, informatively, and concisely, students were able to felicitously and cooperatively contribute to the ongoing environmental argument. The only exception is Jose who appears to violate the conversational maxims of manner (be brief and unambiguous) when he utters "*and if they beat him* [iguana] *up, I would beat them up too* [laughs]" (lines 13–14). Not only does Jose fail to be brief but it is also unclear who are the people he is referring to (i.e., the referent of "they" is never clarified although it can be speculated that "they" are zoo personnel) or why the possibility of the referred people subjecting the iguana to physical abuse or maltreatment is being entertained and explicitly articulated. Although Jose's utterance could be interpreted as a non-cooperative response (i.e., an infelicitous contribution), it should be noted that he is not held accountable by either Ana or other students who could reinforce the Gricean maxims by means such as reprimanding, criticizing, re-voicing, or questioning him. Instead, Jose simply elicits laughter from other discussants, evidence that his contribution in fact constitutes an instance of flouting or exploitation of the Gricean maxims, a communicative strategy previously shown to be used by elementary children to communicate humor and playfulness (Forman, 1992). Despite its superficial humorous character, Jose's contribution is informative (it communicates a biocentric environmental orientation or personal value), relevant, clear, and sincere (he seems to truly care about the iguana's welfare, to the point of publicly making a hypothetical threat to potential aggressors), thus being cooperative at a deeper level.

Excerpt 2 also shows patterns of personal identification that are in sharp contrast to the ones previously noticed in the classroom lights discussion (Excerpt 1). Because students for the most part observe Gricean maxims, they interactionally constitute themselves as cooperative discussants or arguers. Moreover, through their expressed personal concern with the iguana wellbeing and needs, students identify themselves as the type of people who value and care about animals (i.e., implicate an environmentally responsible social identity as animal lovers).

The Fawn in the Woods Dilemma

While reading this dilemma aloud, Ana used the Portuguese word "veado" a literal translation of the term "fawn" from the English version of this card. However, this lexical choice turned out to be problematic, as the word "veado" has two alternate meanings in Portuguese: the formal, literal meaning of "deer" and the colloquial/slang term "faggot." During Ana's read-aloud, two male students (Max and Jose) continued to use the term "veado" but skewed its meaning to that of the slang term "fag" by making comments with a sexual connotation such as: "*Fawn? How 'fawny*' [gay]! [laughs]" and "*Yeah, we would 'eat*' [fuck] *him* [laughs]," which were promptly chastised by Ana with directive comments such as "*let's stop*" and "*please*." From a Gricean perspective, Max and Jose can be said to be resorting to floutings or exploitations of the conversational maxims of manner (avoid ambiguity) and relation (be relevant) to communicate sex-related humor and playfulness. However, unlike in the previous dilemma (Excerpt 2), such student contributions were infelicitous, being met with reprehension from the teacher who promptly held both students

accountable to the Gricean cooperative principle. Despite Max and Jose's uncooperative behavior, students remained engaged in the argumentation about this particular environmental dilemma, for the most part expressing consensual agreement that the fawn should be taken to a safe place, a claim listed on the dilemma card and justified unanimously by the students through the provision of *biocentric warrants* (i.e., statements of personal concern with the fawn's wellbeing and safety that suggested an underlying view of animals as intrinsically valuable and important) (see Table 4).

Uncooperative student behavior continued subsequent to Ana's read-aloud. Jose and Max's humorous floutings persisted after Author 1 opened up the discussion, escalating the confrontational tone of the discussion to a point of outwardly cursing and obscene gesturing:

EXCERPT 3

1	Author 1: A terceira é levaria o filhote pra casa,	Author 1: The third one is to take the fawn home,
2	quem que levaria pra casa? [Idalina e Felipe	who would take him home? [Idalina and Filipe raise
3	levantam a mão]	hands]
4	José: O Filipe gosta de veado! [tom sexual, risos]	Jose: Filipe likes fawns! [sexual connotation, laughs]
5	Filipe: No seu cú aqui, ó [mostra o dedo pro José]	Filipe: In your asshole here [gives Jose the finger]
6	Ana: José! [bate na mesa] José, vira pra frente.	Ana: Jose! [hits student's desk], Jose, turn around.
7	José: A Idalina gosta também!	Jose: Idalina likes [fawns] too!
8	Paulo: Professor, eu deixava ele numa área	Paulo: Teacher, I would move him to a safe area
9	segura.porque ele é um filhote e não tem	because he is just a baby and does not have a
10	uma mãe pra cuidar.	mother to take care of him.
11	Idalina: Nós levaria o filhote para uma área segura	Idalina: We would take the fawn to a safe area
12	porque onde que ele tá tem os caçadores pra	because where he is there are hunters that can kill
13	matar ele.	him.
14	Author 1: Certo, vocês.	Author 1: Right, you.
15	Bruno: Se eu deixasse ele no lugar lá	Bruno: If I left him where he is the predators could
16	os predadores podia comê-lo.	eat him.
17	Author 1: Certo, fala.	Author 1: Right, go ahead.
18	Felipe: Tem que levar ele pra um lugar seguro	Felipe: You have to take him to a safe place where
19	onde é que tem veado pra ele sobreviver junto	there are fawns who he can survive with, like
20	como os irmãos dele ou senão com colegas.	his brothers or buddies.
21	Author 1: Certo	Author 1: Right.
22	Ronaldo: Também um caçador pode ter matado a	Ronaldo: Also, a hunter could have killed his
23	mãe dele, aí eu levava ele pra uma área segura.	mother, then I would take him to a safe place.
24	Author 1: Fala.	Author 1: Go ahead.
25	Natália: Eu levaria ele pra um lugar seguro senão	Natalia: I would take him to a safe place otherwise
26	os outros ia pegar ele e ia matar pra comer.	others could capture him and kill him to eat.

By flouting the Gricean maxims during Ana's read-aloud, Max and Jose altered the data (i.e., the givens or facts) provided in the dilemma. By strategically drawing upon the idea that fawn = faggot, they turned the argumentation about this environmental dilemma into a sexually loaded and confrontational discussion and fostered the unexpected emergence of sexual identities. This is evident in Excerpt 3 when Filipe and Idalina make the unwarranted claim that they would take the ''fawn'' home by raising their hands in response to Author 1's query (lines 1–3). A full-blown confrontation ensues between Filipe and Jose. Taken at face value, there is nothing wrong or suggestive about Filipe' and Idalina's unwarranted claim, but when the word ''fawn'' is exchanged with the word ''fag'' the seemingly simple claim ''I take the *fawn* home'' becomes the sexually loaded claim ''I take the *faggot* home'' and, depending upon subsequent comments from other discussants, the arguer making the claim can be made to assume a unintentional sexual identity (i.e., implicitly identified with regard to his/her

sexual orientation), a discursive possibility particularly threatening for male students. In this particular instance, Filipe's sexual identity emerges as a result of Jose's public declaration of his personal affinity for ''fawns'' (line 4). It should be noted that such emergence is closely related to Jose's lexical and grammatical choices. Instead of referring to the hypothetical ''fawn'' in the story, Jose makes a reference to ''fawns'' in general. Further, his use of the simple present tense suggests that that he is identifying a recurrent or habitual personal behavior, hence humorously implicating that Filipe is the type of person who likes faggots (i.e., implicitly identifying him as a potentially closeted homosexual). Filipe then retaliates by giving Jose the finger (line 5), hence abruptly disrupting the discussion. By contrast, Idalina chooses to simply ignore Jose's sexual innuendo (line 7).

As shown in Excerpt 3, Jose is immediately disciplined by Ana who utters ''*Jose!* [hits student's desk with her hand], *Jose, turn around*'' (line 6). Such strong reprimanding reaction indicates that Jose is being uncooperative by making an infelicitous oral contribution (i.e., he is failing to maintain a cooperative social relationship with his peers). In doing so, Ana invokes the Gricean maxims of manner (avoid ambiguity) and relation (be relevant), marking Jose's humorous flouting as an unacceptable transgression or violation of cooperative social relationship that will not be tolerated. Unlike in the previous discussion about the iguana pet dilemma (Excerpt 2) when he was able to make a humorous yet felicitous contribution, this time Jose makes a statement that is both unclear and has no informational value as sexual orientation is an issue irrelevant and clearly unrelated to the environmental dilemma under deliberation (i.e., a digression unlikely to lead to a reasoned solution to the environmental predicament being considered). Jose is being uncooperative and infelicitous even at a deeper level.

As evident in Excerpt 3, discussion of the fawn in the woods dilemma led to disturbing homophobic patterns of sexual identification and the emergence of student personal identities related to sexual orientation. In the case of Max and Jose, their continual derogatory and sexually explicit comments show that they identify themselves as males who are anti-gay and want nothing to do with homosexuals (known as ''homophobic machos'' in Brazilian culture). Jose even condemns his classmates Felipe and Idalina for wanting to help the ''faggot'' by taking it home, implying that they are crazy or there is something wrong with them (lines 4 and 7). In doing so, Jose distorts his classmates' perception of Felipe' and Idalina's identities who are made to fill unintended sexual roles such as a ''closeted homosexual'' (a male who avoids publicly disclosing his homosexual identity) and a ''fag hag'' (a female with a close friendship relation to homosexual males); two personal identities typically frowned upon in mainstream Brazilian society. These sexual identities and footing were perpetuated throughout the student argumentation about this environmental dilemma.

Through repeated expression of their homophobic sentiments, Max and Jose created a highly oppositional and unsafe social environment for the students to argue in (i.e., make warranted moves from data to claims) for fear that their identity would shift through implicit sexual identification. As shown in Figure 3, such social insecurity had a strong rhetorical impact on this discussion. The most obvious effect was the production of consensual agreement in favor of moving the fawn to a safe place, a claim first introduced by Jose a few minutes prior to Excerpt 3. It should be noted that both Felipe and Idalina alter their selected claims from taking the fawn home (lines 2–3) to taking the fawn to a safe place (lines 11–13 and 15–16) subsequent to Felipe's confrontation with Jose. The fact that Felipe and Idalina do not even articulate the warrants behind their initial claims (lines 2–3), choosing instead to simply alter their selected claim to align themselves with the rest of the class (likely a move aimed at protecting their personal identities) suggests that the consensual resolution of this

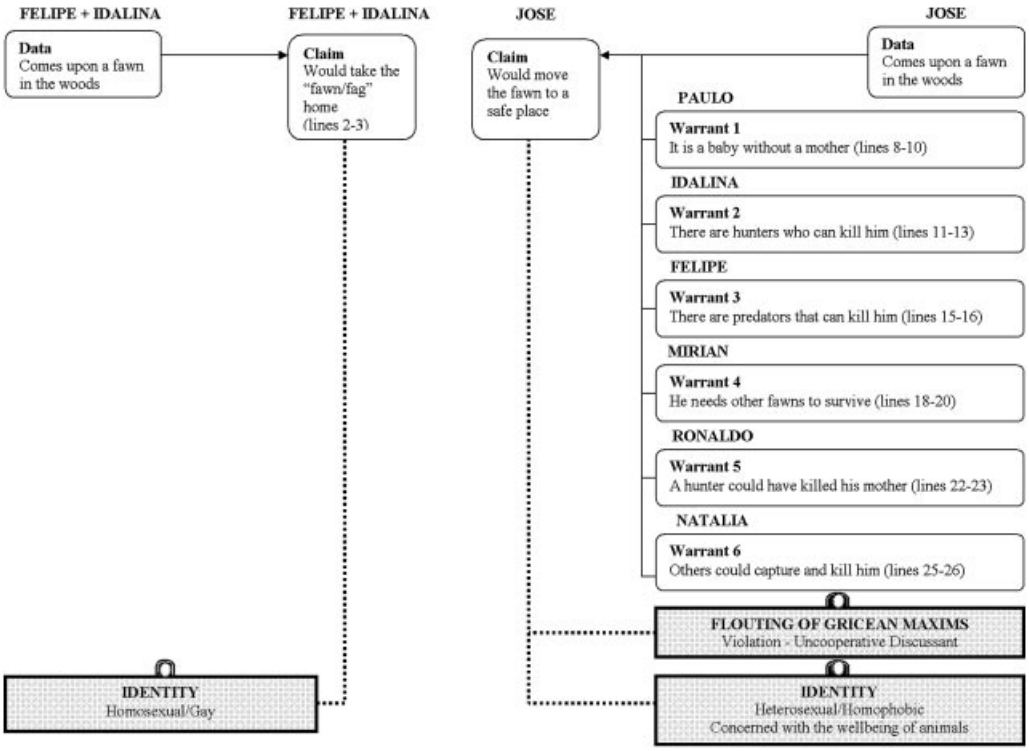

Figure 3. Sociocultural argumentative map of whole-class discussion about the fawn in the woods dilemma.

environmental dilemma was a result of social intimidation, not objective rationality. Put different, the fawn in the wood dilemma was consensually resolved on social rather than rational or reasoned grounds.

Discussion

In this section, we discuss theoretical and empirical links between the reported findings and the existing scholarly literature.

Environmental Dilemmas and Argumentation

As described above, student argumentation about two of our environmental dilemmas (pet iguana and fawn in the woods) was characterized by biocentrism, that is, the predominance of biocentric warrants that emphasized animals' intrinsic right to wellbeing and safety regardless of their usefulness to humans (i.e., the importance of protecting animals for the animals' own sake, not humans' sake). By contrast, student deliberation of the third environmental dilemma (classroom lights) was devoid of biocentrism, with the same students this time providing warrants centered mostly on human affairs (economic, social, and contextual ability) (i.e., expressing anthropocentrism). The co-occurrence of these two highly distinct forms of ecological reasoning among the same group of students within a single lesson suggests that the observed patterns of environmental argumentation are at least partially related

to the environmental dilemmas themselves (as opposed to being merely a reflection of cultural values or moral orientations shared by this particular group of Brazilian students).

When considering environmental harm produced by other humans, students can make different types of moral evaluations and judgments (e.g., decision rightness or wrongness, damage rightness or wrongness, and blaming of decision makers and/or direct agents) depending on whether the intentions and outcomes of these harmful actions are explicitly stated in the dilemma or not. Kortenkamp & Moore (2009) show that children usually make less harsh moral evaluations of biocentrically intended decisions and actions leading to harmful outcomes with reduced severity. However, the environmental dilemmas implemented as part of the present study encouraged students to focus on the environmental impact of their own decisions and actions. Rather than orally evaluating the environmental behavior of fictional characters in a story, students were prompted to make public statement about themselves (as evident in the prevalence of ''I'' statements) by choosing from an open-ended list of claims. Such dilemmas encouraged students to focus their reasoning and arguments exclusively on decision rightness (making the ''right'' decision), affording little room for other forms of moral evaluation such as damage wrongness and blaming. Moreover, because the three environmental dilemmas did not include any explicit statements of intentionality or resulting outcomes, student warrants were limited to articulating their own intentions (i.e., the intended outcomes behind their claims). Whether their claimed intentions could indeed come to fruition and resolve the environmental dilemma under consideration remained a matter of speculation. Lastly, the dilemmas did not include any explicit prompts for evidence (e.g., ''what evidence do you have that this is indeed the best choice?''), instead relying on vague justification requests (e.g., ''what would you do and why?'') that were more likely to elicit unfounded opinions from students.

These instructional shortcomings have practical implications for environmental teaching and learning. They underscore the need for environmental curriculum developers to carefully consider the degree to which proposed environmental dilemmas can potentially promote *emotional indignation* (responsibility-related emotions such as self-blame due to insufficient nature protection by oneself, indignation about insufficient nature protection by others, and anger toward negatively evaluated nature-protective measures) (Gigliotti, 1990; Kals, Schumacher, & Montada, 1999) which has been shown to be important for the development of pro-environmental student behavior. Care must also be taken during the design of environmental dilemmas to ensure that students are explicitly prompted to justify their decisions with evidence which, given their very young age, may simply take the form of previous personal experiences or narratives. Elementary students might also benefit from explicit instruction about the empirical nature of science prior to being engaged in case-based environmental argumentation. Such instruction is likely to improve students' potential difficulties in distinguishing between opinion and data (Simmons & Zeidler, 2003; Zeidler et al., 2002).

Attention should also be given to the morality of environmental dilemmas. For instance, the environmental dilemmas examined in this study provided students with different types of hypothetical moral encounters (Hoffman, 2000) with the environment. The fawn dilemma placed students as *innocent bystanders* who witnessed a young animal in distress. Students were faced with the moral question: Do I help the fawn and how do I feel if I do not help it? By contrast, the pet iguana dilemma positioned students as *potential transgressors* who could harm an animal. The moral issue now was: Do I refrain from harming the iguana? And, lastly, the classroom lights dilemma involved a situation of *multiple moral claimants* wherein students had to choose among clashing socio-moral principles: Do I express my concern for

the environment and risk harming my social relationship with others by directing them to turn off the lights? Not only do these dilemmas have different levels of moral complexity but they are also likely to elicit varied affective responses (empathy, guilt, sympathy, anger, etc.) that can potentially constrain students' ability to engage in rational and scientific environmental argumentation.

Homosexual Identification

An unexpected but significant finding was that the ''fawn in the woods'' dilemma led to disturbing patterns of homophobic discourse highly inconsistent with the goal of respectfully exploring alternative perspectives on environmental issues. It also created a highly oppositional and unsafe social environment, leading to consensual agreement in favor of moving the fawn to a safe place. However, this consensual resolution was the result of social intimidation (threat and fear of undesirable personal identification by peers), not objective rationality. It also created problems for students to maintain cooperative social relationships with peers and to felicitously contribute to environmental argumentation. Such finding underscores the need for educators to pay closer attention to sociocultural aspects of environmental argumentation. Moreover, it highlights the fact that environmental debate does not take place in sociocultural vacuum as students simultaneously negotiate both school tasks and their place in the classroom hierarchy of social status, a dual process that can result in children's nastiness (Lensmire, 1994). Therefore, educators need to carefully consider, when designing and selecting environmental dilemmas, the sociocultural impact of these dilemmas on students' personal identities and social relationships, including the potential emergence of unexpected social identities (e.g., homosexual, fag hag, and homophobic macho) through linguistic means such as infelicitous student contributions and humorous floutings or explotations of Gricean maxims.

Previous anthropological research and current events related to homosexuality in Brazil shed some light on the cultural roots of the above finding. The word ''veado'' (or ''viado'') encodes socially significant cultural values in Brazilian society and is a pejorative term typically used in mainstream society to conjure up the stigmatized image of an extremely feminine male who is both socially and biologically dysfunctional (Parker, 1999). Klein (1999) describes the rapid transformation of homosexual identity in Brazil as a result of changes in the ways that homosexuality is conceptualized and its increased visibility in commercial establishments, political organizations, and coverage of events. More recently, the Brazilian news media has provided extensive coverage of a raging debate over a new curriculum on sexuality education called ''Kit against Homophobia.'' Meant to educate children about diversity and sexuality and address the pervasive problem of hostility against homosexual adolescents in Brazilian schools, this curriculum has been met with a considerable amount of resistance from conservative groups that have accused it of ''promoting homosexuality among children'' (Barros, 2010; Jerônimo, 2011). As evidenced by our observation of homophobic identification among elementary students engaged in environmental education, children can indeed be faced with a hostile classroom filled with discriminatory criticism and pejorative remarks. Such finding, we believe, highlights the need for educational efforts aimed at preventing children from becoming the victims of discrimination and oppression (sexual or otherwise) in classroom settings.

The occurrence of homophobic identification in students' environmental argumentation suggests differences in values toward animals. As emphasized by Kellert (1996; 2002), depending on their cultural background, people can develop different *values of nature*

(i.e., tendencies to associate or affiliate with nature in certain ways). These values play a central role in shaping the human relationship with nature. Like other SSI curricula, our environmental dilemmas reflected scientific and moralistic values of nature, that is, an inclination to intellectually understand the biological world and a concern for human-nature ethical relations. However, these values were not shared by the Brazilian students who preferred to use the animal ''fawn'' (a symbol for homosexuality in Brazilian culture) for the communication of sexual orientation; such preference suggests a symbolic value of animals (i.e., a cultural tendency to develop symbolic relations with animals). Such finding is consistent with those of previous studies showing that cultural background and personal value can have a profound impact on reasoning about socioscientific issues involving animals as varied as squirrels (Evagorou et al., in press), wolves (Jorde & Mork, 2007), bears (Simonneaux & Simonneaux, 2009), snakes (Wojnowski, 2008), seals, hedgehogs, and foxes (Almeida, Vasconcelos, Strecht-Ribeiro & Torres, in press). As such, this finding reinforces the need for environmental educators to carefully consider sociocientific curricula and instruction in light of students' values of animals, particularly social representations (Lopez-Facal & Jiménez-Aleixandre, 2009; Simonneaux & Simonneaux, 2009) and cultural images (Melson, 2001) of animals to which children are exposed.

Argumentation as Sociocultural Activity

Although both ''classroom lights'' and ''iguana pet'' prompted students to set forth a variety of warrants (social, economic, contextual, biocentric, and expertise-based), these dilemmas led to distinct forms of argumentation. Deliberation of the former gave rise to adversarial argumentation characterized by the emergence of an oppositional footing around two incompatible claims, with girls adopting social identities such as challenging evaluators, indirect agents of environmentally responsible action, and sincere discussants who made truthful claims (i.e., consistent with the local classroom context). These identities were indirect opposition to the boys' who assumed the roles of defenders, direct agents of environmental preservation, and insincere and untruthful discussants who made hypothetical claims inconsistent with existing contextual constraints (no light switch).

In contrast, the ''iguana pet'' dilemma led to non-adversarial argumentation centered on two compatible and non-contradictory claims (dropping the iguana off at a vet or a zoo). Although two alternative courses of action were proposed, students did not engage in adversarial argumentation (i.e., did not adopt an oppositional footing), choosing instead to play the role of articulators who did not challenge the contextual validity of others' claims (e.g., the inexistence of a local zoo). Instead, the argument was never brought to a closure (i.e., no consensual agreement was achieved and plural perspectives continued to coexist harmoniously). Moreover, through biocentric warrants and adherence to Gricean maxims, students identified themselves as animal lovers and cooperative discussants able to felicitously contribute to the discussion even when resorting to humorous flouting.

These sociocultural patterns illustrate the linguistic multifunctionality (Silverstein, 1995, 2004) of student oral language in the context of environmental argumentation. This was evident in students' simultaneous use of language for making rhetorical moves (claim, data, and warrant) and performing sociocultural activity (personal identification and cooperative social relationship). Students constructed personal identities and negotiated social relationships implicitly *through* the specific environmental arguments they made. Put differently, in arguing students also inevitably engaged in personal identification and cooperative social relationships with peers. These results are consistent with previous findings reported by

researchers such as Bucholtz and Hall (2005) who provide compelling evidence of the emergent nature of identity in local discourse contexts of interaction, positing that

> ''identity relations emerge in interaction through several related indexical processes, including (a) overt mention of identity categories and labels; (b) implicatures and presuppositions regarding one's own or others' identity position; (c) displayed evaluative and epistemic orientations to ongoing talk, as well as interactional footings and participant roles; and (d) the use of linguistic structures and systems that are ideologically associated with specific personas and groups (p. 594)''

As described above, similar indexical process of identification were observed in the Brazilian students' deliberation of environmental dilemmas, leading to either combative disagreement or consensual resolution on social grounds. Such finding underscores the need for environmental educators to pay closer attention to sociocultural aspects of environmental argumentation. An appropriate and productive sociocultural classroom context needs to be fostered in order for rational and reasoned environmental argumentation to take place without the constraints of unexpected social complications.

Implications and Future Research

It should be acknowledged that the present study is not without limitations. For instance, the availability of data on a single 50-minute class period prevented us from examining students' *trajectories of identity* (Wortham, 2005, 2006), that is, their interactional positioning across longer periods of time (e.g., across units, semesters, or the school year) or situating students' environmental argumentation in broader patterns of classroom activity, thus creating important interpretive limitations such as the impossibility of determining whether the ''fawn'' homophobic incident constituted an isolated instance or a recurring problem in this particular classroom. As emphasized by Lemke (2000), identity development in a given ecosocial system should be analytically considered across multiple timescales. Whether the reported student sociocultural activity and argumentation extends to other classrooms also remains to be determined.

Nonetheless, we believe that our findings have both methodological and theoretical implications for future educational efforts aimed at designing environmental dilemmas that can be used to effectively promote student argumentation. The methodological significance of our study is that it provides environmental educators with a robust analytical tool that can be used to systematically assess and examine the soundness and logical coherence of environmental arguments without overlooking the arguers themselves (i.e., the people behind arguments as well as their social relationships). By combining Grice's maxims and a modification of Toulmin's theoretical model of components of argumentation, our sociocultural argumentative maps enable educators to visualize the process of *argumentative social identification*, that is, how students create and negotiate individual and group identities through argumentation. In our view, this integration of rhetorical and sociocultural visual analysis of oral discourse (to the best of our knowledge, the first of its kind) constitutes a significant methodological advancement, hence making an important contribution to the scholarly study of student environmental argumentation.

The theoretical significance of the reported findings is that they can be used to propose an analytical framework that can be used for systematically examining the focus of environmental dilemmas and argumentation. As shown in Supporting Information Figure 2, this framework encompasses two analytical dimensions. The first dimension (Agent-Action/

Decision-Object) is sociocultural in nature, being concerned with characters' and discussants' personal identities (represented by grey id badges) as well as their social relationships (represented by dotted arrows). This analytical dimension seeks to specify *who* is identified as agents making decision and/or taking action (e.g., the students themselves, other humans) and objects being environmentally affected (e.g., animals, inanimate elements of nature) as well as the social relationships among these multiple parties. The second analytical dimension (Intentions-Action/Decision-Outcomes) is rhetorical and focuses on *what* the characters and discussions under consideration have supposedly done or are expected to do (i.e., their environmental actions and/or decisions) as well as the intentions (e.g., biocentric, anthropocentric) and outcomes (e.g., beneficial or harmful) of their ecological behavior.

For example, looking back at the reported findings through Figure S2 reveals that the three dilemmas examined in the present study prompted students to take on the identities of hypothetical agents of decisions and actions that could potentially affect an iguana, a fawn, and the environment (all identified as passive receivers of environmental action or decision). Such identity structure not only encouraged students to limit the focus of their environmental arguments to the articulation of biocentric intentionality but also led to unexpected social complications that appeared to constrain students' abilities to engage in environmental argumentation through cooperative communication with peers.

In conclusion, the above framework can be used in future research to systematically explore the affordances, limitations, and potential complications of using environmental dilemmas with varied focus (e.g., making and justifying own environmental decisions and actions, giving opinions and making judgments of blame, rightness, or wrongness about others' environmental decisions and actions), genre and stylistic features (fictional narrative, factual expository account), and textual components (types of agents and characters identified in the dilemma, explicit statement of characters' intentionality, and the outcomes of characters' environmental actions) to foster student argumentation. Such research is likely to provide educators with valuable guidance on how to effectively engage students in environmental argumentation without the constraints of unexpected social complications.

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